

AMENDMENT

(Amendment under Art. 11)

To: Commissioner, Patent Office

5 1. Identification of the International Application

PCT/JP03/07574

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4. Scope of Amendments

Specification and claims

5. Contents of Amendments

25 See attached sheets.

(1) On page 8 line 7 to page 9 line 12 in the specification, amend "Laser

machining apparatus for generating the pulsed electric power"
into

"Laser machining apparatus according to the present invention comprises:
a control means for outputting command pulse sets according to control
5 parameter settings for controlling laser pulse output power; a thinning-out
means, into which the command pulse sets are inputted, for thinning out
pulses from the command pulse sets, according to a pulse-width setting as
a control parameter; an electric power supplying means for generating, in
response to command pulse sets outputted from the thinning-out means,
10 pulsed electric power supplied to a load; and a generating means for
pumping, so as to output a laser beam, a laser medium with which a
discharging space is filled, by means of discharge generated by the pulsed
electric power supplied from the electric power supplying means.

In the apparatus, by a plurality of modes being provided according
15 to the pulse width setting, the control means automatically identifying,
according to the pulse width setting, what the mode is, and the control
means outputting a mode-selection signal, the thinning-out means switches
the number of pulses that are thinned out, and then outputs pulse signals.

In the apparatus, the switching period of the inverter circuit is set
20 shorter than both the time constant for the rise/fall of the electric
discharging power and the time constant for the fall of the laser output
power.

Moreover, a control method for laser machining apparatus
according to the present invention, includes the steps of outputting
25 command pulse sets according to control parameter settings for controlling
laser pulse output power, of generating, in response to the command pulse

sets, pulsed electric power supplied to a load, and of pumping a laser medium with which a discharging space is filled, so as to output a laser beam, by means of discharge generated by the pulsed electric power, wherein the method for the apparatus thins out the command pulse sets in response to a pulse-width command as a control parameter so as to change the switching number of an inverter circuit in an electric power supplying means for generating the pulsed electric power".

(2) On page 21 line 1 in the specification, amend "need to be received" into "need to be provided".

(3) On page 23 lines 7 - 8 of claim 1, amend "based on predetermined setting values" into "according to a pulse-width setting as a control parameter".

(4) On page 23 lines 17 - 20 of claim 2, amend "the switching number of an inverter circuit in the electric power supplying means is changed according to orderly thinning-out of the command pulse sets by the thinning-out means" into "by a plurality of modes being provided according to the pulse width setting, the control means automatically identifying, according to the pulse width setting, what the mode is, and the control means outputting a mode-selection signal, the thinning-out means switches the number of pulses that are thinned out, and then outputs pulse signals".

(5) On page 23 line 22 of claim 3, amend "as recited in claim 2" into "as recited in either claim 1 or claim 2".

(6) On page 24 lines 1 - 6 of claim 4, delete this claim.

(7) On page 24 line 17 of claim 5, amend "being orderly thinned-out" into "being thinned-out in response to a pulse-width command as a control parameter".

6. List of attached documents

(1) Page 8 to 9, and page 21 of the specification.

(2) Page 23 to 24 of claims.

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An objective of the present invention, which has been made to solve the foregoing problem, is to provide laser machining apparatus and a control method for the apparatus, in which, in a laser beam machine
5 generating pulse laser beam, its pulse width can be considerably varied at low cost with the heat generation, due to the increase of the switching number, of an electric power supplying unit being prevented.

Laser machining apparatus according to the present invention comprises: a control means for outputting command pulse sets according to
10 control parameter settings for controlling laser pulse output power; a thinning-out means, into which the command pulse sets are inputted, for thinning out pulses from the command pulse sets, according to a pulse-width setting as a control parameter; an electric power supplying means for generating, in response to command pulse sets outputted from
15 the thinning-out means, pulsed electric power supplied to a load; and a generating means for pumping, so as to output a laser beam, a laser medium with which a discharging space is filled, by means of discharge generated by the pulsed electric power supplied from the electric power supplying means.

20 In the apparatus, by a plurality of modes being provided according to the pulse width setting, the control means automatically identifying, according to the pulse width setting, what the mode is, and the control means outputting a mode-selection signal, the thinning-out means switches the number of pulses that are thinned out, and then outputs pulse signals.

25 In the apparatus, the switching period of the inverter circuit is set shorter than both the time constant for the rise/fall of the electric

discharging power and the time constant for the fall of the laser output power.

Moreover, a control method for laser machining apparatus according to the present invention, includes the steps of outputting command pulse sets according to control parameter settings for controlling laser pulse output power, of generating, in response to the command pulse sets, pulsed electric power supplied to a load, and of pumping a laser medium with which a discharging space is filled, so as to output a laser beam, by means of discharge generated by the pulsed electric power, wherein the method for the apparatus : thins out the command pulse sets in response to a pulse-width command as a control parameter so as to change the switching number of an inverter circuit in an electric power supplying means for generating the pulsed electric power.

According to the present invention, the laser pulse width can be considerably expanded with electric discharging voltage being held sufficient to generate discharge.

Moreover, the pulse width can be considerably varied at low cost with the heat, due to the increase of the switching number, generated by the electric power supplying unit being prevented.

Furthermore, by switching the means in response to machining conditions, the machinable range can be expanded wider than that in the conventional one.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a basic configurational view illustrating a pulse laser

that has been set as described above, it does not always need to be provided as a setting item.

In a case of this configuration, because the peak output power of supplied electric power automatically increases or decreases in accordance with whether the thinning-out operations of the command pulse sets outputted from the controller are performed, the peak output power to be set may also be constant; therefore, the peak-output-power setting item does not always need to be provided.

However, when the laser pulse output energy is finely trimmed based on, for example, the discharging voltage increasing or decreasing, the case is not included in this limitation.

According to the present invention, by thinning-out the pulsed electric power ac components, which are supplied from the electric power supplying unit with the command pulse sets being outputted from the controller, by a constant number and at constant intervals, the available pulse width of the laser output power can be considerably expanded without increasing the switching number.

In addition, by bringing both the peak output power and the pulse width of the laser pulse output under simultaneous control, an effect can be obtained, in which control of the pulse laser generator becomes easier than that in the conventional one.

Moreover, by adding a function for switching the thinning-out number of the pulsed electric power ac components, which are supplied from the electric power supplying unit with the command pulse sets being outputted from the controller, an effect is obtained, in which an available

What is claimed is:

1. (Amended) Laser machining apparatus comprising:

5 a control means for outputting command pulse sets according to control parameter settings for controlling laser pulse output power;

a thinning-out means, into which the command pulse sets are inputted, for thinning out pulses from the command pulse sets, according to a pulse-width setting as a control parameter;

10 an electric power supplying means for generating, in response to command pulse sets outputted from the thinning-out means, pulsed electric power supplied to a load; and

a generating means for pumping, so as to output a laser beam, a laser medium with which a discharging space is filled, by means of
15 discharge generated by the pulsed electric power supplied from the electric power supplying means.

2. (Amended) Laser machining apparatus as recited in claim 1,

wherein by a plurality of modes being provided according to the pulse

20 width setting, the control means automatically identifying, according to the

pulse width setting, what the mode is, and the control means outputting a

mode-selection signal, the thinning-out means switches the number of

pulses that are thinned out, and then outputs pulse signals.

25 3. (Amended) Laser machining apparatus as recited in either claim 1

or claim 2, wherein a switching period of the inverter circuit is set shorter

than both the time constant for the rise/fall of the electric discharging power and the time constant for the fall of the laser output power.

5 4. (Deleted)

5. (Amended) A control method for laser machining apparatus, so as to output a laser beam, including the steps of outputting command pulse sets according to control parameter settings for controlling laser pulse output power, of generating, in response to the command pulse sets, pulsed electric power supplied to a load, and of pumping a laser medium with which a discharging space is filled, by means of discharge generated by the pulsed electric power, the method for the apparatus comprising the step of:

15 changing the switching number of an inverter circuit in an electric power supplying means for generating the pulsed electric power, according to the command pulse sets being thinned-out in response to a pulse-width command as a control parameter.